[0186] 51. Segura, M M, Kamen, A, Lavoie, M C, and Garnier, A (2007). Exploiting heparin-binding properties of MoMLV-based retroviral vectors for affinity chromatography. J Chromatogr B Analyt Technol Biomed Life Sci 846: 124-131.

[0187] 52. McNally, D J, Darling, D, Farzaneh, F, Levison, P R, and Slater, N K (2014). Optimised concentration and purification of retroviruses using membrane chromatography. J Chromatogr A 1340: 24-32.

[0188] 53. Whitney, D, McCoy, M, Gordon, N, and Afeyan, N (1998). Characterization of large-pore polymeric supports for use in perfusion biochromatography. J Chromatogr A 807: 165-184.

[0189] 54. Cruz, P E, Goncalves, D, Almeida, J, Moreira, J L, and Carrondo, M J (2000). Modeling retrovirus production for gene therapy. 2. Integrated optimization of bioreaction and downstream processing. Biotechnol Prog 16: 350-357.

[0190] 55. Josephson, N C, and Russell, D W (2010). Production of foamy virus vector and transduction of hematopoietic cells. Cold Spring Harb Protoc 2010: pdb prot5481.

[0191] 56. Kiem, H P, Allen, J, Trobridge, G, Olson, E, Keyser, K, Peterson, L, et al. (2007). Foamy-virus-mediated gene transfer to canine repopulating cells. Blood 109: 65-70.

[0192] 57. van der Loo, J C, Swaney, W P, Grassman, E, Terwilliger, A, Higashimoto, T, Schambach, A, et al. (2012). Scale-up and manufacturing of clinical-grade self-inactivating gamma-retroviral vectors by transient transfection. Gene Ther 19: 246-254.

What is claimed is:

1. A method of preparing FV vector particles, comprising the steps of:
   a. transfecting a population of eukaryotic cells by contacting said population of eukaryotic cells with one or more transfection reagents to form a transfection mixture, and incubating said transfection mixture to form a transfected cell population;
   b. harvesting said FV vector particles from said transfected cell population, wherein said harvesting step is carried out about 70 hours to about 100 hours, or about 70 hours to about 90 hours, or about 70 hours to about 80 hours, or about 72 hours to about 75 hours, post-transfection;
   c. purifying said FV vector particles;
   d. concentrating said FV vector particles.

2. The method of claim 1 wherein said population of eukaryotic cells are pre-seeded for about 20 to about 30 hours, or about 24 hours, prior to said transfecting step.

3. The method of claim 1 wherein said pre-seeding is carried out until said population of eukaryotic cells achieves a cell density of from about 1×10^5 cells/cm^2 to about 2×10^5 cells/cm^2 or about 1.8×10^5 cells/cm^2.

4. The method of claim 1, wherein said pre-seeding step comprises the step of plating eukaryotic cells 1 day prior to PEI transfection with fresh media.

5. The method of claim 1 wherein said pre-seeding step comprises adding poly-L-lysine in an amount sufficient to pre-coat tissue culture plastic with about 3.5 to about 10 mL per 225 cm^2 surface area, preferably at a concentration of about 0.01%.

6. The method of claim 1 wherein said one or more transfection reagents comprise vector plasmid and a plasmid comprising codon optimized pCiGAGopt.

7. The method of claim 1 wherein said transfecting step occurs in the presence of about 10% (vol/vol) fetal bovine serum and about 0.4% (vol/vol) PEIPro.

8. The method of claim 1, wherein said transfecting step occurs in the presence of about 10% fetal bovine serum and calcium phosphate, butyrate, and chloroquine.

9. The method of claim 1, wherein said transfection mixture is incubated for about 10 to about 20 minutes at ambient temperature (20-24° C.), preferably for about 10 minutes.

10. The method of claim 1, wherein said transfection mixture is maintained in the initial media until the day of harvest.

11. The method of claim 1, wherein the pH of said transfection mixture is less than about 8.

12. The method of claim 1 wherein said FV vector particles is subjected to a filtration step.

13. The method of claim 1 wherein said transfected cell population is contacted with benzonase at a concentration of from about 50 to about 200 U/mL, preferably about 50 U/mL in the presence of about 10 mM MgCl$_2$ for a period of from about 2 to about 6 hours, preferably about 4 hours prior to a filtration step in one instance, and for 16 to 40 hours prior to vector harvest in another.

14. The method of claim 1 further comprising the step of isolating said FV vector particles using a heparin column.

15. The method of claim 1 further comprising the step of concentrating said FV vector particles using tangential flow filtration.

16. The method of claim 1, further comprising the step of concentrating said FV vector particles, followed by dilution to about 140 mM to about 160 mM, preferably about 150 mM NaCl.

17. The method of claim 1 further comprising the step of concentrating said FV vector particles using tangential flow filtration.

18. The method of claim 1 further comprising the step of concentrating said FV vector particles using ultracentrifugation.

19. The method of claim 1 wherein said FV vector particles are stored at a temperature of about −70° C. to about −90° C., preferably about −80° C. in the presence of DMSO.

20. The method of claim 1 wherein said FV vector particles are stored frozen in the presence of from about 3 to about 5% DMSO, preferably about 5% DMSO.

21. A method of obtaining an increased titer of FV vector particles, comprising the steps of:
   a. pre-seeding a population of eukaryotic cells for about 20 to about 30 hours, or about 24 hours, wherein said pre-seeding is carried out until said population of eukaryotic cells achieves a cell density of from about 1×10^5 cells/cm^2 to about 2×10^5 cells/cm^2 or about 1.8×10^5 cells/cm^2;
   b. transfecting a population of eukaryotic cells by contacting said population of eukaryotic cells with one or more transfection reagents, wherein said one or more transfection reagents comprise vector and a plasmid comprising codon optimized pCiGAGopt, wherein said plasmid is used at a concentration of about 0.16 to about 10.4 microgram per 75 cm^2 culture surface